

Amendments to the Claims:

This Listing of Claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Original) A method for the conversion of a carbon-based fuel to a H₂-rich product gas, comprising the steps of:
 - (a) providing a carbon-based fuel;
 - (b) converting said carbon-based fuel to an intermediate gas product by contacting said carbon-based fuel with at least a first conversion catalyst;
 - (c) contacting said intermediate gas product with an absorbent material to absorb CO₂ and form a H₂-rich gas, said absorbent material having a theoretical absorption capacity for CO₂;
 - (d) extracting said H₂-rich gas from said contacting step;
 - (e) regenerating said absorbent; and
 - (f) repeating said steps (a), (b), (c), (d) and (e) at least 10 times, wherein said absorbent material retains at least about 50 mol.% of said theoretical absorption capacity after each of said repeating steps.
2. (Original) A method as recited in Claim 1, wherein said converting step comprises steam reforming of said carbon-based fuel.
3. (Original) A method as recited in Claim 1, wherein said converting step is selected from the group consisting of autothermal reforming, partial oxidation and catalytic partial oxidation of said carbon-based fuel.
4. (Original) A method as recited in Claim 1, further comprising the step of contacting said H₂-rich gas with a water-gas shift catalyst.
5. (Original) A method as recited in Claim 1, wherein said repeating step comprises repeating steps (a), (b), (c), (d) and (e) at least 50 times.
6. (Original) A method as recited in Claim 1, wherein said repeating step comprises repeating steps (a), (b), (c), (d) and (e) at least 100 times.
7. (Original) A method as recited in Claim 1, wherein said repeating step comprises repeating steps (a), (b), (c), (d) and (e) at least 500 times.

8. (Original) A method as recited in Claim 1, wherein said absorbent material retains at least about 70 mol.% of said theoretical capacity after said repeating step.

9. (Original) A method as recited in Claim 1, wherein said absorbent material retains at least about 90 mol.% of said theoretical capacity after said repeating step.

10. (Original) A method as recited in Claim 1, wherein said repeating step comprises repeating steps (a), (b), (c), (d) and (e) at least 200 times and wherein said absorbent material retains at least about 10 mol.% of said theoretical absorption capacity after said repeating step.

11. (Original) A method as recited in Claim 1, wherein said repeating step comprises repeating steps (a), (b), (c), (d) and (e) at least 200 times and wherein said absorbent material retains at least about 25 mol.% of said theoretical absorption capacity after said repeating step.

12. (Original) A method as recited in Claim 1, wherein said repeating step comprises repeating steps (a), (b), (c) and (d) at least 200 times and wherein said absorbent material retains at least about 50 mol.% of said theoretical absorption capacity after said repeating step.

13. (Original) A method as recited in Claim 1, wherein said absorbent material comprises at least one metal oxide selected from the group consisting of Group IA and Group IIA metal oxides.

14. (Original) A method as recited in Claim 1, wherein said absorbent material comprises a calcium-containing compound.

15. (Original) A method as recited in Claim 1, wherein said absorbent material comprises CaO.

16. (Original) A method as recited in Claim 1, wherein said absorbent material comprises CaO:MgO.

17. (Original) A method as recited in Claim 1, wherein said absorbent material comprises CaO and from about 1 wt.% to about 40 wt.% Al₂O₃.

18. (Original) A method as recited in Claim 1, wherein said contacting step occurs at a temperature of not greater than about 800°C.

19. (Original) A method as recited in Claim 1, wherein said carbon-based fuel is a hydrocarbon-based fuel.

20. (Original) A method as recited in Claim 1, wherein said carbon-based fuel is a gaseous fuel.

21. (Original) A method as recited in Claim 1, wherein said carbon-based fuel comprises methane.

22. (Original) A method as recited in Claim 1, wherein said carbon-based fuel comprises a liquid fuel.

23. (Original) A method as recited in Claim 1, wherein said carbon-based fuel comprises a liquid fuel selected from the group consisting of diesel fuel, JP-8 aviation fuel, kerosene, ethanol and gasoline.

24. (Original) A method as recited in Claim 1, wherein said H₂-rich gas comprises at least about 95 mol.% H₂ after each said repeating steps.

25. (Original) A method as recited in Claim 1, wherein said regenerating step comprises heating said absorbent material to a temperature of at least about 700°C.

26. (Original) A method as recited in Claim 1, wherein said absorbent material is pelletized.

27. A method as recited in Claim 1, wherein said absorbent material is coated on a support structure.

28. (Original) A method as recited in Claim 1, wherein said absorbent material has substantially spherical morphology

29. (Original) A method for the conversion of a carbon-based fuel to a H₂-rich product gas, comprising the steps of:

- (a) providing a carbon-based fuel;
- (b) converting said carbon-based fuel to an intermediate gas product by contacting said carbon-based fuel with at least a first conversion catalyst;
- (c) contacting said intermediate gas product with an absorbent material to absorb CO₂ and form a H₂-rich gas, said absorbent material having an theoretical absorption capacity for CO₂;
- (d) extracting said H₂-rich gas from said contacting step;
- (e) regenerating said absorbent; and

(f) repeating said steps (a), (b), (c), (d) and (e) at least 10 times, wherein said total mass of absorbent material retains at least about 10 grams CO₂ per 100 grams unreacted absorbent after each of said repeating steps.

30. (Original) A method as recited in Claim 29, wherein said absorbent material retains at least 20 grams CO₂ per 100 grams unreacted absorbent after each of said repeating steps.

31. (Original) A method as recited in Claim 29, wherein said absorbent material retains at least 30 grams CO₂ per 100 grams unreacted absorbent after each of said repeating steps.

32. (Original) A method as recited in Claim 29, wherein said absorbent material retains at least 40 grams CO₂ per 100 grams unreacted absorbent after each of said repeating steps.

33. (Original) A method as recited in Claim 29, wherein said absorbent material retains at least 50 grams CO₂ per 100 grams unreacted absorbent after each of said repeating steps.

34. (Original) A method as recited in Claim 29, wherein said absorbent material is pelletized.

35. (Original) A method as recited in Claim 29, wherein said converting step comprises steam reforming of said carbon-based fuel.

36. (Original) A method as recited in Claim 29, wherein said converting step is selected from the group consisting of autothermal reforming, partial oxidation and catalytic partial oxidation of said carbon-based fuel.

37. (Original) A method as recited in Claim 29, further comprising the step of contacting said H₂-rich gas with a water-gas shift catalyst.

38. (Original) A method as recited in Claim 29, wherein said repeating step comprises repeating steps (a), (b), (c), (d) and (e) at least 50 times.

39. (Original) A method as recited in Claim 29, wherein said repeating step comprises repeating steps (a), (b), (c), (d) and (e) at least 100 times.

40. (Original) A method as recited in Claim 29, wherein said repeating step comprises repeating steps (a), (b), (c), (d) and (e) at least 500 times.

41. (Original) A method as recited in Claim 29, wherein said absorbent retains at least about 70 mol.% of said theoretical absorption capacity after said repeating step.

42. (Original) A method as recited in Claim 29, wherein said absorbent retains at least about 90 mol.% of said theoretical absorption capacity after said repeating step.

43. (Original) A method as recited in Claim 29, wherein said repeating step comprises repeating steps (a), (b), (c), (d) and (e) at least 200 times and wherein said absorbent material retains at least about 10 mol.% of said theoretical absorption capacity after said repeating step.

44. (Original) A method as recited in Claim 29, wherein said repeating step comprises repeating steps (a), (b), (c), (d) and (e) at least 200 times and wherein said absorbent material retains at least about 25 mol.% of said theoretical absorption capacity after said repeating step.

45. (Original) A method as recited in Claim 29, wherein said repeating step comprises repeating steps (a), (b), (c) and (d) at least 200 times and wherein said absorbent material retains at least about 50 mol.% of said theoretical absorption capacity after said repeating step.

46. (Original) A method as recited in Claim 29, wherein said absorbent material comprises at least one metal-oxide selected from the group consisting of Group IA and Group IIA metal oxides.

47. (Original) A method as recited in Claim 29, wherein said absorbent material comprises a calcium-containing compound.

48. (Original) A method as recited in Claim 29, wherein said absorbent material comprises CaO.

49. (Original) A method as recited in Claim 29, wherein said absorbent material comprises CaO:MgO.

50. (Original) A method as recited in Claim 29, wherein said absorbent material comprises CaO and from about 1 wt.% to about 40 wt.% Al_2O_3 .

51. (Original) A method as recited in Claim 29, wherein said contacting step occurs at a temperature of not greater than about 800°C.

52. (Original) A method as recited in Claim 29, wherein said carbon-based fuel is a hydrocarbon-based fuel.

53. (Original) A method as recited in Claim 29, wherein said carbon-based fuel is a gaseous fuel.

54. (Original) A method as recited in Claim 29, wherein said carbon-based fuel comprises methane.

55. (Original) A method as recited in Claim 29, wherein said carbon-based fuel is a liquid fuel.

56. (Original) A method as recited in Claim 29, wherein said carbon-based fuel comprises a liquid selected from the group consisting of diesel fuel, JP-8 aviation fuel, kerosene, ethanol and gasoline.

57. (Original) A method as recited in Claim 29, wherein said H₂-rich gas comprises at least about 95 mol.% H₂ after said repeating step.

58. (Original) A method as recited in Claim 29, wherein said regenerating step comprises heating said absorbent material to a temperature of at least about 700°C.

59. (Original) A method as recited in Claim 29, wherein said absorbent material is pelletized.

60. (Original) A method as recited in Claim 29, wherein said absorbent material is coated on a support structure.

61. (Original) A method as recited in Claim 29, wherein said absorbent material has substantially spherical morphology.

62. (Original) A method for the conversion of a carbon-based fuel to a H₂-rich gas, comprising the steps of:

- (a) providing a carbon-based fuel and steam;
- (b) converting said carbon-based fuel and said steam to an intermediate gas product by contacting with at least a first conversion catalyst;
- (c) contacting said intermediate gas product with an absorbent material to absorb CO₂ and form an H₂-rich gas, said absorbent material having a theoretical absorption capacity and wherein at least said absorbent material is pelletized;
- (d) extracting said H₂-rich gas from said contacting step;

(e) regenerating said absorbent; and
(f) repeating said steps (a), (b), (c), (d) and (e) at least 50 times,
wherein said absorbent material retains at least about 20 mol.% of its theoretical
CO₂ absorption capacity after each of said repeating steps.

63. (Original) A method as recited in Claim 62, wherein said absorbent
material retains at least about 40 mol.% of said theoretical CO₂ absorption capacity after
each of said repeating steps.

64. (Original) A method as recited in Claim 62, wherein said absorbent
material retains at least about 60 mol.% of said theoretical CO₂ absorption capacity after
each of said repeating steps.

65. (Original) A method as recited in Claim 62, wherein said absorbent
material retains at least about 90 mol.% of said theoretical CO₂ absorption capacity after
each of said repeating steps.

66. (Original) A method as recited in Claim 62, wherein said absorbent
material retains at least 10 grams CO₂ per 100 grams unreacted absorbent material after
each of said repeating steps.

67. (Original) A method as recited in Claim 62, wherein said absorbent
material retains at least 20 grams CO₂ per 100 grams unreacted absorbent material after
each of said repeating steps.

68. (Original) A method as recited in Claim 62, wherein said absorbent
material retains at least 30 grams CO₂ per 100 grams unreacted absorbent material after
each of said repeating steps.

69. (Original) A method as recited in Claim 62, wherein said absorbent
material retains at least 40 grams CO₂ per 100 grams unreacted absorbent material after
each of said repeating steps.

70. (Original) A method as recited in Claim 62, wherein said absorbent
material is regenerated at least about 100 times and wherein said absorbent material
retains at least about 20 mol.% of said theoretical CO₂ absorption capacity.

71. (Original) A method as recited in Claim 62, wherein said absorbent
material has substantially spherical morphology

72. (Original) A method as recited in Claim 62, wherein said first conversion catalyst is a steam reforming catalyst.

73. (Original) A method as recited in Claim 62, further comprising the step of contacting said H₂-rich product gas with a water-gas shift catalyst.

74. (Original) A method as recited in Claim 62, wherein said absorbent material comprises at least one metal oxide selected from the group consisting of Group IA and Group IIA metal oxides.

75. (Original) A method as recited in Claim 62, wherein said absorbent material comprises a calcium-containing compound.

76. (Original) A method as recited in Claim 62, wherein said absorbent material comprises CaO.

77. (Original) A method as recited in Claim 62, wherein said absorbent material comprises CaO and from about 1 wt.% to about 40 wt.% Al₂O₃.

78. (Original) A method as recited in Claim 62, wherein said absorbent comprises CaO and a metal oxide selected from the group consisting of Al₂O₃ and MgO.

79. (Original) A method as recited in Claim 62, wherein said first conversion catalyst comprises a metal selected from the group consisting of Rh, Ni, Ru, Pt, and Pd.

80. (Original) A method as recited in Claim 62, wherein said contacting step occurs at a temperature of not greater than about 800°C.

81. (Original) A method as recited in Claim 62, wherein said regenerating step comprises heating said absorbent material to a temperature of at least about 700°C.

82. (Original) A method as recited in Claim 62, wherein said conversion catalyst is pelletized with said absorbent material.

83. (Original) A method as recited in Claim 62, wherein said H₂-rich product gas comprises at least about 95 mol.% H₂.

84. (Original) A method for absorption enhanced reforming of a carbon-based fuel, comprising the steps of:

- (a) providing a carbon-based fuel;
- (b) contacting said carbon-based fuel with at least a first conversion catalyst to catalyze the formation of an intermediate gas product;

(c) contacting said intermediate gas product with a pelletized absorbent compound having a first bulk density, wherein said pelletized absorbent is converted to a carbonized absorbent having a second bulk density; and

(d) regenerating said carbonized absorbent to form a regenerated absorbent having a third bulk density, wherein said third bulk density is greater than said first bulk density.

85. (Original) A method as recited in Claim 84, wherein said third bulk density is up to about 140% of said first bulk density.

86. (Original) A method as recited in Claim 84, wherein said regenerating step comprises heating said carbonized absorbent to a temperature of at least about 700°C.

87. (Original) A method as recited in Claim 84, wherein said carbon-based fuel is a hydrocarbon-based fuel.

88. (Original) A method as recited in Claim 84, wherein said carbon-based fuel is gaseous fuel.

89. (Original) A method as recited in Claim 84, wherein said carbon-based fuel comprises methane.

90. (Original) A method as recited in Claim 84, wherein said carbon-based fuel is a liquid fuel.

91. (Original) A method as recited in Claim 84, wherein said carbon-based fuel is selected from the group consisting of gasoline, kerosene, jet fuel, bio-oil from carbon.

92. (Original) A method as recited in Claim 84, further comprising the step of providing steam with said carbon-based fuel.

93. (Original) A method as recited in Claim 84, further comprising the step of providing steam, or an oxygen-containing gas with said carbon-based fuel.

94. (Original) A method as recited in Claim 84, wherein said absorbent compound comprises a calcium-containing compound.

95. (Original) A method as recited in Claim 84, wherein said absorbent compound comprises CaO.

96. (Original) A method as recited in Claim 84, wherein said absorbent compound comprises CaO:MgO.

97. (Original) A method as recited in Claim 84, wherein said absorbent has substantially spherical morphology.

98. (Original) A method as recited in Claim 84, wherein said regenerating step comprises heating said absorbent compound to a temperature of at least about 700°C.

99-202. (Canceled herein)